

(NASA-TM-109282) HOW TO SHARPEN
YOUR BIDDING (NASA) 5 p

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HOW TO SHARPEN YOUR BIDDING

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Introduction

This color slide presentation is a summary of a 48-hour college credit course, "How to Sharpen Your Bidding", or "Plan Reading and Estimating", which has proven to be a great help to Contractors, Engineers, Craftsmen, Secretaries, Owners, Government Administrators and Technicians. It shows color-keyed slides of a course outline, 20 page set of Plans of Propellant System Component Laboratory, 86 item Unit Price Schedule, Outline Specifications, Construction Bar Chart Schedule-CPM, and Detail Final Estimate for the Architectural and Structural portions of the General Construction. This course consists of special lectures and discussions on prices, cost escalation and labor productivity, methods, bid strategy, cost, construction management, overhead, contingencies, earthwork, concrete, masonry, structural steel, lumber, millwork, interior finishes, specifications, mechanical and electrical design and "How Does the Successful Low Bidder Get Low and Make Money?" This exciting course has produced such student comments as "Why didn't I get this 10 years ago?", "I didn't know I could learn so much in such a short time" and "learning can be fun and profitable", as most have become more successful in the construction industry.

Background

In February 1965, I started part-time teaching for Brevard Junior (Community) College in Civil Engineering Technology. The courses I developed and taught were: (1) Estimating and Blueprint Reading, (2) Construction Planning Equipment and Methods, (3) Construction Law and Specifications for Engineers, and (4) Contractors Licensing Review.

I researched the textbooks and everything I could find and really learned that you have to know more about your subject to teach it. I found this to be a new and exciting experience which I enjoyed especially since most of the students had construction experience (building Missile Launch Facilities for Moon Rockets and the building boom in Central Florida) and many were graduate engineers. But their questions kept me on my toes. With their special reports on methods, law, and field costs; and, my active participation in AACE, I started formulating ideas for this paper. Although it really goes back to 1956-59 when I learned my basic construction at the University of Florida's Department of Building Construction and when I worked for a Registered Professional Engineer-General Contractor in Jacksonville where we had a very small overhead, the Boss, his daughter (the secretary), and my-

self. This meant that I was the Estimator, Project Manager, Sub-Coordinator, Draftsman, Cost Controller, etc., for over \$2,325,000 of construction on over \$7,000,000 of bidding. Quite a lot of experience in four years for the son of a plumber.

My next four years experience was with the Canaveral District Office (CANDO), Corps of Engineers where I prepared and/or reviewed construction cost estimates and assisted in negotiations with general and sub-contractors for modifications, using CPM evaluation for over \$115,000,000 of Cost Estimates. These were for Navy, Air Force and NASA, Kennedy Space Center, General Construction and Missile Launch Facilities for Moon Rockets. Man's landing on the moon is today's greatest success story and it was the biggest challenge of the construction industry, climaxed with Armstrong's "That's one small step for man, one giant leap for Mankind."

This paper is based on my accumulative personal job experience in this exciting field.

Two basic methods of learning, "Plan Reading and Estimating" are: (1) Learning to Draw Them - take mechanical drafting in high school or college, (2) Go to work for an Architect, Engineer, or Contractor and start reading, and asking many questions and getting some back. Both methods are time consuming and expensive especially when mistakes cost money.

My method is to teach Plan Reading by "doing" (not drafting) by Quantity Surveying and Estimating in the classroom. After all, isn't an estimate a test of the estimator's ability to read the plans? Another excellent method of keeping their interest high is to have them bid against each other. We all know competition is the mainstay of the construction industry. The bidding tests their Quantity Survey, Estimating and Bidding Strategy. These methods have proven very successful in teaching students with such varied educational backgrounds from 8th grade to college graduate engineer.

Course Outline

As you will witness, from the Course Outline, Attachment A, this is an action-packed 15 to 16 week sessions of 3 hours each class which can be varied to meet the individual students and engineers needs. More time, one to four weeks, may be spent on Basic Plan Reading or more time may be spent on Detail Estimating, Cost Control, Feed-back, the areas that can sharpen bidding.

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The first class centers around the students with the Introduction and Background experiences. Many are skilled craftsmen, Junior College students, general or sub-contractors, Aerospace, Office Manager, Planners, Schedulers, and Estimators. Since no one is an expert in all fields, we share out construction experiences; which gives me feedback and gives them an opportunity to become personally involved and to evaluate others as each of us must do in construction, with emphasis on honesty, professional code of ethics and background of construction industry such as duties of Architects, general and sub-contractors, owners, etc. The United States Gypsum Handbook, "How to Read Blueprints (HTRBP)" is used as a review or in detail to familiarize novices or new construction students with scales, architect and engineer symbols, terminology, plans, elevations, isometric drawings, detail, sections and specifications. The HTRBP questions are used for homework assignments and discussed in class. They are especially good since they are ambiguous and are sometimes the basis for exuberant and animated class discussion.

The second class involves Contingencies - How Much and Why - and are discussed with their needs in Program, Budget, and Preliminary Cost Estimates but should not be necessary in Final Detail Estimates. A sample Detail Estimate of overhead is developed for a \$100,000 to \$1,000,000 typical job with taxes, insurance and profits, their relationships to each other. Then a home study problem is given with labor and material costs. Each student submits his bids for a formal bid opening. A discussion on the Wide Range Bids follows with constructive criticism ideals vs facts of life 3% profit to 25%. Basic of Quantity Surveying are discussed with review of Areas, Volumes and Decimal System Emphasized for listing dimensions.

The third class reviews the Propellant System Component Laboratory (PSCL) plans. They are especially appropriate since they have some of the typical ambiguities between the finish schedule, sections and structural details. It is a 4100 SF concrete masonry, single story structure with reinforced concrete column beams, walls, and bar joist. It is a simple building but has lots of details and types of finishes. General rules for estimating is based on Richardson's 1971 edition of Commercial-Industrial Construction Estimating and Engineering Standards, Walker's, and Means Building Construction Cost Data, and my philosophy of: (1) review the plans, (2) review the specifications and make a detail checklist, (3) study plans and make a detail quantity survey and add items to checklist not in specifications such as special notes, etc., (4) price-out,

(5) summarize, (6) check and review, (7) have an associate, a supervisor or a boss give final review.

Give lecture on site work, layout, earthwork and start detail takeoff of buildings, fill, etc.

The fourth class is a lecture on concrete, formwork and reinforcing and start detail takeoff of footing, columns, beams, walls, slab, and canopies.

The fifth class is a detail takeoff of formwork and reinforcing and a 30-minute pop quiz on abbreviations, math for quantities and volumes, and questions and quantity on PSCL plans.

The sixth class is a masonry lecture on concrete block, brick, mortar and detail takeoff. Since building masonry varies with building configurations an alternate approach is discussed.

The seventh class is a lecture on structural steel and also the design of building for steel bar joist using Steel Joist Institute (SJI) tables and discussions on building design from the top down and estimated and built from the bottom up. Detail takeoff of steel bar joist, and miscellaneous steel angles, etc., and erection.

The eighth class is a lecture and detail takeoff of lumber, millwork and rough carpentry. The home study assignment is a construction inspection office 8' x 8'. A detail takeoff and bid is made. A list of items and prices and sketch are furnished. Sometime the size is changed to force them to resketch rough framing.

The ninth class is a lecture on decks, gypsum, steel, light-weight concrete and roofing, and sheet metal. A sample deck section is passed around to let them have a feel of it and detail takeoff of deck and roofing. If time permits, I discuss some of the different estimating forms, various contractors use to summarize their estimate from 1 page to a 13 page detail form with cost account numbers which is ideal for a computerized estimating-accounting-management system for a \$1-20 million building project.

The tenth class is a lecture and discussion on interior finishes such as ceramic tile, vinyl asbestos tile, base, acoustical tile and suspension systems - with simple square foot takeoff quantities. Sample tiles are passed around to get the feel of them.

The eleventh class is a lecture and discussion on metal lathe and plaster, takeoff by the square yard and painting, caulking, wall covering, interior and exterior - with importance of the painting sub-contractor who can make a poor general contractor look good or a good contractor look bad. Interior and exterior doors, frames and hardware are covered with emphasis on the importance of the timely arrival of steel door frames for masonry walls. We then takeoff all the interior finishes using the special Joe A. Brown (JAB) systemized takeoff based on the finish schedule and the need for the general contractor to check the quantities on the many sub-contractor items that he may be more competitive on.

The twelfth class - Prices (Attachment B) and the specifications are discussed. The unit cost schedule for labor and materials of the 86 items (takeoffs in class) were good for KSC/Cape work in January 1965. I found that many were still good in the Orlando area for light commercial and residential work in 1970-71 when I taught "How to Sharpen Your Bidding" for the Central Florida Trade and Technical School. A

list of 15 estimating and pricing books is also discussed with emphasis on the importance of the estimate to "Know Your Cost" for building the job and basing your bid on that and not on what your competitor can do it for; as a general or sub-contractor specializes in certain phases of construction and are more efficient and therefore more competitive. Design is one of the biggest variables in the cost of facilities. An example is in the cost of warehouses where they vary from \$4.00 to \$50.00 per square foot. Labor productivity being the other most variable cost in construction and estimating from 10% to 200% of estimated cost. Material cost used to be the one thing you could bet on and some bid shoppers picked up 2 to 20%, but in these days of shortages - concrete block, cement, oil, steel, toilets - these prices may escalate 2 to 20% during construction and procurement time may double the project duration. Time permitting I present my technical papers: (1) "Construction Bidding Cost of LC-39" Launch Pad for Moon Rockets with discussion on the bid abstracts and unit prices used. This paper was presented at the AACE 12th Annual Meeting in Houston, Texas in 1968, (2) "Construction Cost Escalation and Labor Productivity. . . What Can We Do About It??", which was presented at the First International Cost Engineering Symposium in 1971 in Montreal, Canada, (3) "How Does the Successful Low Bidder Get Low - and Make Money???" presented at the AACE 17th National Meeting in St. Louis, 1973. The papers are presented with color slides and are accompanied by the NASA/Corps of Engineers 28-minute color sound movie, "The Big Challenge", which shows the construction of Kennedy Space Center's Moon Port, LC-39. This movie exhibits dredging, pile driving, structural steel erection, pouring concrete, fabricating reinforcing steel, brick and block masons, formwork, the custom built siding rail cars used to install over 1,000,000 square feet of insulated siding and prefabrication of the extensible platforms for the VAB. All papers are printed in the AACE Transactions, with the paper on Cost Escalation being a first place winner in Technical Writing Competition sponsored by the Society for Technical Communication.

The Estimate Summary is discussed with emphasis on Cost Control, item cost per concrete block, square foot, cubic yard, square, etc., listed on estimate to cross check this estimate with past jobs and future bids. An example of errors in recent bids such as on omission of the electrical work for a major project. The students are asked to prepare their own estimate for bidding. The critical path method for scheduling is discussed as an aid for estimating before each bid and for actual construction and payment after they get the job.

The thirteenth class is a lecture on mechanical estimating with Herbert Herkimer's "Cost Manual for Piping and Mechanical Construction", John Gladstone's "Mechanical Estimating Guidebook", Richardson Engineering Standard MBM's "Building Cost File", and NAPHCC (National Association of Plumbing, Heating and Cooling Contractors) "Labor Calculator" used as the basis.

The fourteenth class - the students estimate is due and we have a formal bid opening and discuss the wide bid range and errors. It is better to evaluate the students bids than on a hard money base. The students usually have more enthusiasm after spending 20 to 150 hours on their estimate. A 2 1/2 hour open book test is given with estimating problems, and question on plan reading symbols, abbreviations, decimals, and estimating.

The fifteenth class is an electrical power and light lecture with NECA (National Electrical Contractor Association) Manual of Labor Units, R. S. Means Building Construction Cost Data as the basis and review the PSCL electrical plans which display the lighting, communication, transformers, fire alarm risers, panel schedules, power plan and electrical diagram. The importance of knowing the Code and other electrical requirements is emphasized since many electrical items are not listed on the plans but are necessary and must be included in the estimate.

The final exam is graded in class as I believe the students should know their mistakes and thereby gain confidence in their corrected answers is one of the most important parts of the learning process.

In conclusion, this course has been a great help to all who complete the course and has especially helped those general and sub-contractors and working estimators sharpen their bidding.

ATTACHMENT A COURSE OUTLINE

WEEK NO.	SUBJECTS
1	Introduction: General Construction, Estimating, Blueprint Reading, Experience and Background Survey (Walkers p1-100, & 1642-1652 HTRBP ¶ 3, 4, & 5)
2	Contingencies, Job Overhead, General Overhead, Taxes & insurance, Profit, Abbreviation, Checklist Area, decimals (H. study Bid Problem Wp 100-217 HTRBP ¶ 6 & 7)
3	General Rules for Estimating, Site Work, Excavating, Piling, Earth work, start take-off (W p217-319 HTRBP ¶ 9 & 10)
4	Concrete, footings, col. bms, slab, & walls (W p. 319-495)
5	Formwork & reinforcing foot. col., bms, slab & wall - Pop Quiz (W. p495-691 masonry)
6	Masonry Lecture & Take-off exterior & interior walls (W. p1421-1537 struct. steel)
7	Structural steel, bar joist misc. Lecture & take-off (W. p871-967 & 1277-1353)

- 8 Lumber & Millwork, rough carpentry lecture & T.O. (Inspector's Office, W. p967-1123)
- 9 Gypsum & Steel - lt. wt. concrete decks, roofing & sheet metal (W. pl123-1277 & pl377-1421) estimating forms
- 10 Interior Finishes, Ceramic Tile, vinyl asbestos tile, acoustical tile, suspension system (W. pl611-1642)
- 11 Metal lathe & plaster, walls & ceiling painting & caulking, doors, special JAB Systemized Interior Take-Off Summary (Means Cost Data & W. 1611-1642)
- 12 Prices, specifications, "Low Bidders Make Money?" "Cost Escalations & Labor Productivity" Estimate Summary & Cost Control (W. 1477-1603) & CPM
- 13 Plumbing-Piping Fixtures, Heating, Ventilation & Air Conditioning Ductwork (W. pl603-1611)
- 14 OPEN BOOK EXAM - Estimate Due
- 15 Electrical - power and lights, instrumentation, communication, safety alteration - Grade Exam

14. Concrete Walls 7.00 cu.yd. 17.00 cu.yd.
15. Concrete Suspended Slabs 9.00 cu.yd. 17.00 cu.yd.
16. Concrete Slab Finishing .12 s.f. ---
17. Concrete Curing .03 s.f. .03 s.f.
18. Concrete Hardener .03 s.f. .03 s.f.
19. Expansion Joint $\frac{1}{2}$ " x 5" .10 L.F. .12 L.F.
20. Expansion Joint $\frac{1}{4}$ " x 8" .12 L.F. .18 L.F.
21. Reinforcing Steel 80.00 Ton 200.00 Ton
22. Welded Wire Mesh 6x6 10/10 .02 s.f. .03 s.f.
23. Formwork for Footings .25 L.F. .15 L.F.
24. Formwork for slabs .30 L.F. .15 L.F.
25. Formwork for columns .50 s.f. .40 s.f.
26. Formwork for beams .65 s.f. .50 s.f.
27. Formwork for walls .40 s.f. .30 s.f.
28. Formwork for stoops .30 L.F. .15 L.F.
29. Formwork for canopies .75 s.f. .50 s.f.
30. Concrete Block .30 ea. .30 ea.
31. Sound Block .55 s.f. .60 s.f.
32. Mortar 4.00 cu.yd. 20.00 cu.yd.
33. Wall Reinforcing .02 L.F. .10 L.F.
34. Concrete lintels, precast 1.00 L.F. 1.50 L.F.
35. Concrete sills, precast 1.00 L.F. 1.50 L.F.
36. Splahs Block Precast 2.00 ea. 8.00 ea.
37. Steel Angle .10 lb. .12 lb.
38. Bar Joist 100.00 Ton 250.00 Ton
39. Misc. Metal Items 25.00 Lot 150.00 Lot
40. Painting, Bar Joist 20.00 Ton 10.00 Ton

ATTACHMENT B
ESTIMATING & BLUEPRINT READING
UNIT PRICE SCHEDULE

Item	Labor	Material
1. Layout	L.S. \$175	L.S. \$75
2. Hand Excavation	4.00 c.y.	---
3. Machine Excavation	1.50 c.y.	---
4. Backfill & Compaction	1.50 c.y.	---
5. Fill Dirt	.25 c.y.	1.00 c.y.
6. Fine Grading	.03 s.f.	---
7. Compaction	.03 s.f.	.02 s.f.
8. Concrete Footings	4.00 cu.yd.	17.00 cu.yd.
9. Concrete Slab	3.00 cu.yd.	17.00 cu.yd.
10. Concrete Stoops	5.00 cu.yd.	17.00 cu.yd.
11. Concrete Canopy	5.00 cu.yd.	17.00 cu.yd.
12. Concrete Columns	7.00 cu.yd.	17.00 cu.yd.
13. Concrete Beams	9.00 cu.yd.	17.00 cu.yd.

41. Gypsum Deck & Formboard	.30 s.f.	.20 s.f.	65. Bullet proof glass	15.00 ea.	50.00 ea.
42. Pressure treated lumber	.15 b.f.	.15 b.f.	66. Misc. rough hardware	50.00 L.S.	200.00 L.S.
43. Rigid Insulation	.07 s.f.	.08 s.f.	67. Signs	5.00 L.S.	100.00 L.S.
44. 5-Ply B-U T&G Roof	10.00 sq.	9.00 sq.	68. Hardware Set No. 1	20.00 ea.	205.00 ea.
45. Waterproof Membrane	.07 s.f.	.05 s.f.	69. Hardware Set No. 2	10.00 ea.	100.00 ea.
46. Aluminum Gutters	.75 L.F.	.75 L.F.	70. Hardware Set No. 3	10.00 ea.	80.00 ea.
47. Aluminum Downspout	.75 L.F.	.75 L.F.	71. Hardware Set No. 4	15.00 ea.	135.00 ea.
48. Aluminum Fascia	.65 L.F.	.60 L.F.	72. Hardware Set No. 5	10.00 ea.	80.00 ea.
49. Aluminum Awning Windows	.50 s.f.	2.00 s.f.	73. Hardware Set No. 6	Included in door cons't	
50. Plywood	.20 s.f.	.20 s.f.	74. Hardware Set No. 7	10.00 ea.	90.00 ea.
51. Film Transfer Cabinets	75.00 ea.	265.00 ea.	75. Caulking - gun grade	.15 L.F.	.10 L.F.
52. Cement Plaster Ceiling	.40 s.f.	.40 s.f.	76. Polysulfide	.50 L.F.	.25 L.F.
53. Cement Plaster Wall	.30 s.f.	.30 s.f.	77. Painting, walls, 2 coats	.07 s.f.	.06 s.f.
54. Ceramic Tile, Wall & Floor	.75 s.f.	.75 s.f.	78. Painting Doors	10.00 ea.	2.00 ea.
55. Acoustical Ceil- ing/sus. system	.15 s.f.	.35 s.f.	79. Painting, Ceil- ing, 2 coats	.08 s.f.	.07 s.f.
56. Steel Doors	15.00 ea.	100.00 ea.	80. Painting Exterior	.09 s.f.	.07 s.f.
57. Aluminum Doors	20.00 pr.	300.00 pr.	81. Vinyl Asbestos Tile 1/8"	.07 s.f.	.22 s.f.
58. Aluminum Louver Doors	20.00 pr.	400.00 pr.	82. Vinyl Baseboard	.15 L.F.	.25 L.F.
59. Aluminum Door, Reg.	15.00 ea.	150.00 ea.	83. Accessories Toilets	20.00 L.S.	57.00 Lot
60. Lead lined wall	.50 s.f.	3.00 s.f.	84. Toilet Partitions	20.00 ea.	90.00 ea.
61. Physicist	300.00 L.S.	---	85. Toilet Screens	10.00 ea.	60.00 ea.
62. Lead lined door	3.00 s.f.	10.00 s.f.	86. Venetian Blinds	.25 s.f.	.75 s.f.
63. Lead lined glass	5.00 ea.	50.00 ea.			
64. Lead louver	50.00 ea.	50.00 ea.			